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SAVING SOIL

WITH SOD
IN THE
OHIO VALLEY
REGION

FARM LANDS are more scarce and costly today than when this country was being developed. The day of wearing out a farm and moving on to a piece of virgin soil at comparatively small expense is over. The present-day farmer realizes not only that he should conserve the soil to support himself throughout his lifetime but also that he has a responsibility to posterity. He knows it is poor economy to exploit the soil for a short period, only to find that the temporary prosperity has resulted in loss of topsoil, in lower production per acre, and eventual poverty, when only fields of gullied subsoil remain. He knows that returns from the land should not be taken at the price of the land itself but should be only such as are possible when he protects his heritage and investment, the topsoil. This reasoning brings farmers to think of means of farming profitably on sloping, erodible land, and sooner or later they will make a wider use of sod.

Grass has been given a prominent place in the farming pattern of land lying east of the Mississippi River, but grassland has not been managed so as to be continuously productive. Too often grass has been put on the most worn-out areas of the farm, which have then been given little care. Under better management, grass produces economical feed in pasture and meadow and increases yields on cropland when used in rotations or as a cover for the land when it is not in other crops. The use of grass in increasing the productivity of farm land, in conserving soil on pasture and cropland, and in protecting smaller eroded or erodible areas is discussed in this bulletin.

The recommended practices have general application throughout the Ohio River drainage basin and Michigan. More detailed information applicable to localities within this region may be obtained from State agricultural experiment stations and county agricultural agents.

SAVING SOIL WITH SOD IN THE OHIO VALLEY REGION

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FROM FOREST TO ERODED LAND

TWO HUNDRED YEARS AGO the scout saw great forests on all sides as he followed the Ohio River headwaters in Pennsylvania down tortuous watercourses to the Mississippi. Years later, white men's families came over the Appalachian divide, following animal and Indian trails. They pitched their camps in well-watered glades, in small natural meadows surrounding watering places of wild animals, or in clearings made by Indians.

In these open spaces, their livestock grazed a variety of grasses and legumes, most of which can still be found in woodlands (fig. 1, A), marshes, and areas that once were prairie openings in the forest. Though still found here and there, not one of these native plants is now of much economic importance in the Ohio Valley Region,¹ which comprises Michigan, Indiana, Ohio, Kentucky, and Tennessee.

Trees were, and still are, the climax vegetation in the Ohio Valley. Native grasses maintained themselves only where trees were unable to compete because of localized conditions. Only on extremely wet spots, dry shallow soils, and in paths and clearings were the grasses able to supplant the woody vegetation. Grasses and clovers that now cover millions of acres in this region were introduced by the white man and established themselves only after the forests were removed. In this natural woodland empire trees regenerate and reestablish themselves without the help of man, but

¹The Ohio Valley Region is one of the 10 administrative regions of the Soil Conservation Service. All but small parts of the four southernmost States in this region are in the Ohio River drainage basin, which includes also parts of 10 other States. (See map on back cover.)



FIGURE 1.—From forests (A) to eroded fields (B); from eroded fields to unproductive pastures (C).

grasses and clovers still remain as visitors, which thrive only so long as men protect them against the forest's return.

Except for the comparatively small areas in sod, virgin loams of the Ohio Valley Region were formed under forest conditions. The high fertility of these woodland soils was soon realized by early settlers, and in a relatively short span of years the Ohio Valley and adjacent areas were settled and changed from wilderness to rich farming country. Timber, for the most part, was disposed of by fire, the simplest expedient, and by the traditional early-day log rolling. The soil was plowed and cropped to corn and small grains. If spared from cultivation and left for meadow or pasture, fields soon established a cover of native grass species. During the nineteenth century, however, the native vegetation was gradually replaced by imported grasses and clovers. Most common of the meadow and pasture grasses and legumes now planted by farmers are Kentucky bluegrass, redtop, Bermuda grass, timothy, the brome grasses, and orchard grass; white, red, crimson, and hop clovers; alfalfa, sweet-clover, annual lespedezas, and *Lespedeza sericea*, every one of which has been imported from foreign lands.

Although the white man cleared the Ohio Valley and helped sod to form over most of it, he was responsible also for destroying large areas of that sod by bringing about soil conditions that could not support it. So long as the fields held a covering of fertile topsoil, farmers had no difficulty in establishing and maintaining luxuriant grass and clover cover. But continued cultivation and the destructive effects of erosion finally depleted the original layer of topsoil or carried most of it away (fig. 1, B). Fields then became so unproductive that they were abandoned, and more virgin timberland was cleared for grain cropping.

The impoverished and eroded fields became the farmer's pasture land (fig. 1, C). Usually when most of the farm had been cleared and cropped, the pasture and meadowlands were again cultivated, cropped, and subjected to erosion. In due time the process was repeated. Soil-building and soil-protecting effects of the grasses could scarcely get under way when return to cultivation canceled the recovery and took further toll in soil losses. Eventually, only the least eroded land remained permanently in cultivation. The most eroded land, usually on steep slopes, no longer produced profitable crops and was either definitely abandoned or allowed to become poor pasture land with low carrying capacity. When the land had gone through this cycle several times during a period of approximately 100 years, pastures ceased to offer much in the way of palatable forage. They became mere browsing grounds and are today, for the most part, little more than exercise lots for livestock.

In spite of this destructive process, good sod might have been produced if some of the lime and phosphate robbed through years of cropping and erosion had been returned to the land and if the grasslands had been protected from fire and overgrazing. But these precautions were not taken. Farmers suited their actions to the exigencies of the times. As their soil became less productive and yields dropped, they increased crop acreages so as to maintain total produc-

tion. Cultivated crops were crowded into already impoverished sod lands and pushed up to steeper slopes. This reduction in pasture acreage was seldom accompanied by a corresponding reduction in the number of livestock on the farm. The inevitable result was overgrazing and further erosion. Overgrazing crowded out the better pasture plants, weeds came in, and, finally, sheet wash accentuated the formation of gullies, many of which were originally started while the land was under cultivation. This is the condition of large areas of the Ohio Valley today. Fortunately, not all agricultural land is so seriously depleted. The problem is to keep the good land good, and meanwhile to rebuild, slowly, some of the best of the land that has been mismanaged.

HOW SOD SAVES SOIL AND WATER

A thin topsoil under sod indicates that the soil has been exposed to erosion in previous years by the plow, fire, or overgrazing and that the loss of topsoil took place during periods when there was no adequate sod or forest protection. The original depth of topsoil is found only in the few remaining virgin timber areas or in small areas that have been maintained in good sod since clearing.

Dense sod established on eroded land will reduce erosion to a negligible amount, will gradually build up the organic content of the soil (fig. 2, *A*), and will ordinarily increase the fertility of the soil. The protective and soil-improving action of sod can be observed readily on most farms, and experimental plots at soil and water conservation experiment stations provide ample proof of the erosion-resistant qualities of sod. It not only decreases soil loss but holds water in the soil.

At the Northwest Appalachian Soil and Water Conservation Experiment Station at Zanesville, Ohio, 4 years of erosion and run-off data show practically no loss of soil by erosion on 12-percent slopes, limed and fertilized and maintained in bluegrass sod. Under comparable conditions of soil and slope, the annual soil loss was approximately 63 tons per acre on land cropped continuously with corn. That sod has a decided effect on run-off as well as soil loss is also borne out by these experiments. Nearly eight times as much rainfall ran off the corn plots as off the bluegrass plots.

Raindrops falling on bare soil have a puddling effect and tend to seal or clog the soil pores with fine soil particles. The water then has less chance of entering the soil, and the amount of free surface water is increased. Dense vegetation prevents puddling by breaking the impact of the raindrops (fig. 2, *B*). The rain trickles down the grass and clover stems, through the residue of decaying organic matter, and reaches the soil at a minimum velocity.

The stems and accumulation of partly decayed leaves on the surface constitute millions of tiny dams that slow the velocity of run-off, decrease its power to move soil particles, and allow the water more time to enter the soil. The rootstocks and masses of fibrous roots further reduce erosion by binding the soil particles and holding them against movement.



FIGURE 2.—*A*, Masses of roots form under sod. Their decay adds humus to the soil. *B*, stems and leaves break the impact of the raindrops, and the organic debris at the surface of the soil constitutes millions of tiny dams to slow the run-off.

The soil in good sod land is comparatively high in organic matter because of root decay and the accumulation of surface residue; and the action of the roots and the accumulated organic matter tend to make the soil more open and granular, and hence more porous. As a result, rainfall that otherwise would become surface run-off is stored in the soil to increase growth during periods of drought, or it may seep away slowly to springs or underground reservoirs. Again using the figures from the Zanesville station and calculating the average annual rainfall of the Ohio Valley at approximately 40 inches, it is demonstrated that a good sod may retain as much as 14 inches of rainfall that on cornland would be lost as run-off. This additional moisture becomes available for plant growth, and water retained in the soil can have no erosive effect as run-off.

Because good grass or grass-legume cover offers almost 100-percent protection against loss of soil by erosion, it is given a front-line position in the Nation's program for soil conservation. Sod prevents erosion and pays returns not only on pastures and meadows, but on cultivated fields, in orchards, in gullies, on highway banks, and on sand-dune areas. When the land is put in grass, soil erosion can be checked, and at a profit to the farmer, for grass is an income-producer no less than a conservator of the soil.

SOD IN MEADOWS AND PASTURES

PROFITS IN WORN-OUT MEADOWS AND PASTURES

Thirty-three percent of the agricultural land in the Ohio Valley States is in pasture. Millions of acres of this pasture in the Ohio Valley Region are nothing more than impoverished and gullied lands, where weeds, brush, scrub timber, broomsedge, and poverty grass put forth a scrawny growth. Unless the farm actually has been abandoned, farmers still run their livestock in such areas. Hungry for a monthful of palatable forage, the animals hunt out the bits of bluegrass and other desirable plants, eat them to the ground, and thus destroy the few remaining wisps of once-luxuriant meadows. Cultivation, erosion, overgrazing, and fire have left these large areas under a thin plant cover; a mantle of hungry roots and starving leaves. Today it is the farmer's task to feed these roots. Most poor and eroded farm land can be brought into good pasture through applications of seed, lime, and fertilizer, and through managed grazing. It is probable that the best pasture should receive first attention. If more pasture can be used profitably, the poorer pastures can then be improved or more land put into pasture, even at considerable expense.

Even some of the most severely eroded land may be developed into good grassland. Cultivated crops are seldom profitable on infertile land, whereas pasture and meadow, although yielding better on more fertile land, may be used on some poorer land on grades as high as 30 to 40 percent. But if the land is too steep, subject to severe drought, and badly gullied, and if it is difficult to maintain it in grass and clover, even with treatments and good management, its best use may be as woodland. If replanted or protected from grazing and allowed

to revert to woodland, it will prevent further erosion and yield approximately the same income as pasture. Woodland cannot be re-established under grazing, and in some sections its return is further prohibited by fire, which too often is started by the hand of man in the mistaken idea that it will assist in bringing back the desirable grasses. Fire not only damages sod and woodland plants, but it destroys valuable organic matter and thus further decreases the fertility of the soil.

There is a too prevalent opinion among farmers that it is not good economy to spend money on worn-out pasture. This attitude is based on the belief that returns from pasture are not comparable to returns from cropland. This fallacy arises largely from comparing returns from poorly managed pastures with those from cropland on which all available funds have been spent. Pastures often are on the most eroded and worn-out land on the farm, and it is generally true that no money has been spent to make them productive, and little effort. It must be remembered that pasture land did not wear out under good pasture management. The soil had been impoverished before the pasture was established. On such land no lime, manure, or other fertilizer has been applied, and overgrazing has been common. It is no wonder, then, that the pasture is unproductive and does not yield returns comparable to those from rotated cropland.

Many farmers have not appreciated the feeding value of grass and clover as compared with that of other crops. Farms have been ruined by increasing the area of land under cultivation so that more concentrated feeds, such as corn and small grains, would be available for livestock on the farm. Pasture and forage crops, it was thought, were of low feed value and should therefore not be grown where there was opportunity to grow more concentrated feeds. Corn and small grain were planted on the sloping land, where inevitable erosion has robbed the farmer of his topsoil. Farmers are now learning that money put into improvement of pastures and meadows will pay dividends and at the same time protect and build up the soil.

On lands too steep for cultivation, but regular and even enough for the use of mechanical harvesters (fig. 3), good yields may be obtained from permanent meadows. Meadows improve the soil and protect cultivated fields below them from erosion. They afford supplemental pasture with which to rest the pastures at certain seasons.

Several experiment stations have shown that dairy and beef products may be produced on practically an entire grass and legume ration at considerably greater profit than on more concentrated rations. The total production in pounds of milk and livestock may be somewhat reduced when forage almost completely replaces concentrates, but the cost of the forage is so much less that the net profit, in many instances, is considerably increased.

An experiment carried on by the Ohio Agricultural Experiment Station under conditions comparable to those prevailing on good farms in northeastern Ohio was made to study the effect of increasing the rate of hay feeding on the amount and cost of milk production. The hay used was mostly mixtures of alfalfa and timothy.

Daily rations containing 30 pounds of hay and 15 pounds of corn silage were compared with rations of 15 pounds of hay and 40 to 45 pounds of corn silage. In addition, a grain ration was used in small amounts in the heavy hay ration and more liberally in the light hay ration. This experiment has shown that the cows on the heavy hay ration produced a little less milk but almost as much butterfat as the cows on the light hay-heavy grain ration. Feed costs were lower, however, and returns over feed costs were higher on the heavy hay-light grain ration.

Farther south in the Ohio Valley Region the growing season lengthens, and there is a corresponding increase in the number of pasture feeding days per year. Some recent work in Tennessee indicates that milk and beef production on pasture and hay may prove to be a profitable type of farming. At the West Tennessee Experiment Station two groups of dairy cows are being alternated after two complete lactation periods between an all-year pasture, silage, and



FIGURE 3.—On this Michigan farm the slopes too steep or irregular for cultivation are kept under an alfalfa-brome grass meadow.

alfalfa-hay diet and a similar diet with the addition of grain. Over a period including five winters, an average of 340 days of pasture was available out of every 375 days of lactation. The no-grain cows received 74 percent of total digestible nutrients from pasture, whereas cows with a supplementary grain ration received 52 percent. The production of butterfat by cows receiving no grain was 92 percent of the amount produced by cows fed grain, and the estimated cost for producing a pound of butterfat on no grain was 16.82 cents as compared with 18.25 cents when grain was fed.

At the Middle Tennessee Experiment Station cows on a limited-grain feeding and all-year pasture were compared with those on a full-grain feeding and summer pasture. The experiment showed that good all-year pasture feeding averaged 346 pasture days and reduced the concentrates required as much as 1,000 pounds per cow,

or nearly 50 percent below the requirements of average summer-pasture practice, which included only 198 pasture days. The milk and butterfat production was slightly lower on a limited-grain ration than on a full-grain ration, but the income over feed cost was greater.

At this station an experiment is now under way in which finished beef is being produced on an all-year pasture-hay ration (with only a small addition of cottonseed meal) at a considerable profit over the usual pasture-grain feeding.

The experiments on both milk and beef production are made on treated pastures under a pasture-management plan, and costs of pasture improvements are included.

There is ample evidence from experiment station records of the feeding value of pasture, and more and more farmers each year are demonstrating that the development of good pasture offers the dairy and beef man opportunity for cheapening production and increasing profits.

RESTORING ROW-CROP LAND TO PASTURE

Increasing interest in the substitution of forage for grain and corn silage in cattle feeding led to recent tests in northeastern Ohio to determine the economy of retiring a larger percentage of rolling, irregularly sloped land to permanent pasture. The tests indicate that eroded hillsides can be so used profitably. In many instances, some of the acreage now in corn for silage can well be seeded to legume-grass mixtures, since recent investigations indicate that these mixtures can be successfully ensiled.

The ensiling of forage crops prevents the loss of leaves through shattering, utilizes all stems, and provides for a palatable supplemental feed for burnt-out pastures during the late summer months. It reduces fire hazards from the spontaneous combustion of improperly stored hay and makes possible an economical and reasonable reduction in row-crop acreage in accord with a practical soil conservation and land use program.

Where circumstances are favorable, farmers can profitably produce their own seed (fig. 4). They then are assured of its adaptability, and, because cost of production is low, they are not restricted in the use of seed. If seed crops of grasses and clover were grown on much low-production land that is now in row and cultivated crops, acre returns might be increased, soil erosion on such land would be reduced, and soil fertility increased.

HOW TO ESTABLISH SOD

A great many farmers are realizing with satisfaction that it is possible to get good productive pastures and meadows even on infertile subsoils. Certain grasses and legumes are adapted to such conditions. These plants may not be the most desirable, but they will control erosion and build up the soil fertility until more desirable pasture or meadow plants follow. For example, sweetclover may be established on worn-out land in the bluegrass belt by the application

of fairly heavy amounts of lime and phosphate. After a year or two of sweetclover the soil fertility has usually improved enough to permit the planting of white clover, redtop, and orchard grass with a fair chance of success. Fields inhabited by a good stand of these plants can usually be brought into bluegrass gradually.

Grasses and legumes require a certain environment for best growth, as do cotton, corn, wheat, and other crops. The conditions required by grass and legume turfs should always be considered when planting. For example, Kentucky bluegrass is rather slow-growing and



FIGURE 4.—The soil on this slope is protected from erosion and is producing a valuable clover-seed crop.

tender in the seedling stage and under normal conditions requires 2 to 3 years to form a dense turf. It also requires a comparatively fertile soil for satisfactory growth. Grasses such as redtop, orchard grass, and Canada bluegrass, however, will grow under more unfavorable conditions and are more suitable for planting on eroded areas. Once these grasses are established, they will aid in building up the soil, under proper treatment, and bluegrass can eventually be established.

In Tennessee and Kentucky, Bermuda or Kentucky bluegrass following crimson clover or lespedeza is much improved by the effect of the legume. In Ohio and Indiana on the poorer soils bluegrass pastures are most readily obtained following sweetclover or alfalfa.

In Michigan it is common for bluegrass to follow the alfalfa-brome-grass meadows, which are proving adaptable to the comparatively dry Michigan summers.

On numerous farms in the Ohio Valley determined farmers have established fine bluegrass or Bernuda sod on steep, eroded areas that previously grew only poverty grass and broomsedge. The cost was often as much as \$10 per acre or more in seed, lime, and fertilizer. Invariably this cost has been justified. Ten acres or more of poverty grass are usually required to pasture one head of livestock. Under suitable treatment the same areas become sufficiently productive within a few years to carry one head of livestock on 3 or 4 acres. The cost of treatment is returned, and the profit per acre increased. Moreover, the soil is anchored and will not lose its fertility as fast as when a cultivated crop is grown. In fact, through increasing the organic matter in soil, good pasture may increase the soil productivity considerably.

On the H. A. Studor farm, Muskingum County, Ohio, a number of old poverty grass fields were treated in an attempt to build up the fertility of the fields to a point where good meadow and pasture could be grown. On one of these fields (fig. 5, A) the slopes ranged from 20 to 30 percent and were eroded until not more than 25 percent of the topsoil remained. At a cost of approximately \$12 per acre for initial treatment a stand of sweetclover was established. Alfalfa was later planted after additional soil amendments were applied at a cost of \$3 per acre.

The returns on this investment increased every year, and the profit from the sale of alfalfa harvested the fifth year after treatments were begun was in itself sufficient to pay the initial expense. The field is now protected from erosion and is yielding a good income.

On the Studor farm another field lying on a 20-percent slope was cultivated for many years before being abandoned to pasture. Seventy-five percent of the topsoil had been lost through erosion. The soil is derived from sandstone and shale. After being in poverty grass for many years the field was treated in 1931 with lime and fertilizer and seeded to sweetclover, timothy, and a small amount of Kentucky bluegrass at a cost of approximately \$10 per acre. By careful management of cutting and grazing, an appreciable return has been received from grass hay and sweetclover and timothy seed. The field had an excellent cover in the summer of 1935 just after timothy seed had been harvested. It produced a thick growth of desirable plants, including sweetclover, redtop, and bluegrass.

This field (fig. 5, B) was still well protected against erosion in the spring of 1938. The initial investment for improvement was paid for during the second year by the sale of sweetclover seed and hay. The field is now highly productive pasture land with a rated carrying capacity of one animal unit per acre, as against poverty grass with a carrying capacity of one animal unit per 7 to 8 acres.

Grasses usually should be planted in the fall so that they may become established before they have to survive summer temperatures and competition from weeds. Because legumes planted either with the grass or later cannot supply nitrogen for initial grass growth,



FIGURE 5.—*A*, After an expenditure of \$15 per acre for soil amendments this alfalfa stand was produced on a formerly eroded poverty grass field, like the field on the right; *B*, Improvement of this pasture increased normal carrying capacity from 7 or 8 acres per animal unit to 1 acre per animal unit.

some nitrogen should be applied on poor soils at planting time to insure proper seedling growth. Also, the usual recommendations for lime and superphosphate may be far from sufficient because of the low fertility of the subsoil.

In tests in northeastern Ohio yields on typical pastures were measured on 10 farms. Parts of pastures were treated with $1\frac{1}{2}$ tons of ground limestone and 400 pounds of 20-percent superphosphate per acre. The first-year results indicated that insufficient plant nutrients have been the limiting factor in pasture production. The pasture treatments brought about a change to more desirable species of pasture grasses. They also increased the average amount of bluegrass and white clover more than 200 percent and reduced the weed content about 50 percent. There was a wide variation in production on various pastures, the better pastures responding more favorably than the poorer. There was an average increase in production of 50 percent on a dry-weight basis, and the pastures showing the best gains provided approximately 10 tons of green roughage per acre, which compares favorably with a 10-ton yield of corn silage. On another basis these pastures also produced more feed per acre than an average of a 3-year rotation yielding 50 bushels of corn, 20 bushels of wheat, and 2 tons of clover and timothy hay.

In the second year after treatment the pastures continued to improve, the treated areas producing 95 percent more vegetation than the untreated areas, as compared with a 50-percent increase the first year. There was also a greater difference in the type of vegetation on the treated and untreated areas than in the first year; the treated areas produced six times more white clover and more than three times as much Kentucky bluegrass.

PASTURE MANAGEMENT FOR SOIL IMPROVEMENT AND INCREASED YIELDS

Grazing or clipping may affect grasses and clovers either favorably or unfavorably, depending on the duration and severity of the grazing and the season. Controlled grazing in pastures stimulates sod formation and favors continued growth. Overgrazing tends to restrict sod formation and to decrease growth, and it may eventually kill the plants.

To understand the necessity for proper grazing, the function of the green parts of the plants must be known. The green leaves of grasses and clovers are comparable to a factory. It is here that the plant foods, sugars and starches, are manufactured and transferred to the growing parts of plants. This process is called photosynthesis. It operates through the agencies of sunlight, carbon dioxide from the air, minerals and nitrogen drawn from the soil or other parts of the plant in solution, and chlorophyll, an active agent in the leaves that is responsible for the green color and aids in manufacturing foods. If the leaf surface is decreased the manufacture of plant food is reduced, and growth is restricted in the roots as well as in the stems, leaves, and seeds.

Any restriction in root growth in turn affects the top growth, since the plant is not able to draw upon moisture or to get plant foods

from sufficient depths. Also, at certain seasons manufactured food should be stored in the roots. But if growth of green parts is so restricted that all the food the plant is able to manufacture is immediately used for new growth, no food will be stored. A good example of injury of this nature is afforded by the losses of alfalfa stands. These are often due to untimely fall grazing or cutting, which removes the green parts when root reserves for winter and early spring should be manufactured and stored.

Grazing too closely also injures some plants by cutting off the growing point or bud. This delays growth until enough time has elapsed for buds near the base to produce new shoots. Canada bluegrass, for example, is more subject to this type of injury than Kentucky bluegrass, because its habit of growth is such that at certain stages of plant development the growing point is elevated above the surface of the soil sufficiently to expose it to injury or removal by close grazing.

Controlled grazing, on the contrary, encourages the growth of new shoots and the replacement of the leaves and stems removed by grazing. It is difficult to describe the limits of proper grazing, but, roughly, pastures of bluegrass, redtop, and Bermuda grass should not be grazed more closely than 2 to 3 inches from the soil. Clipping or grazing grass in the spring decreases the shading effect of the tall grass and thickens the sod. This is especially important in bluegrass and white clover pastures, where the tall grass may retard and even smother the white clover in the spring, when the clover should be making its most vigorous growth. Clipping pastures at certain seasons removes flower heads of certain weeds and thus prevents their reseeding. It also tends to even pasture or meadow stands by stimulating new growth in mature patches of grass that the livestock have avoided. In this connection, droppings should be scattered several times a year to encourage more uniform grazing.

SEASONAL CONTROL OF GRAZING

Probably the most important phase of pasture management is the seasonal control of grazing. Except in years of drought, there is usually sufficient pasturage in the Ohio Valley during the spring and fall. Because many farmers in the more favorable seasons attempt to carry the same number of livestock through the summer and winter, they turn the cattle on pasture that should not be grazed; the pastures are injured and become progressively poorer year after year.

The number of feeding units should not exceed pasture available during summer and winter plus the supplemental pasture and hay available. There is considerable opportunity for the provision of summer supplemental pasture in the Ohio Valley, where meadow aftermath is available and crops such as alfalfa, sweetclover, lespedeza, reed canary grass, and Sudan grass may be provided easily. South of the Ohio River pastures may be used for winter grazing, if left ungrazed during the previous fall so that a thick mat of grass remains to protect the soil from the puddling effects of trampling

while it is wet and from early and frequent freezing, so that the growth of the grass is prolonged into or through the winter (fig. 6). Crops such as ryegrass and small grains also may afford convenient and inexpensive winter pasture.

Large areas of pasture are ruined during the winter and early spring by running livestock on them when the soil is in a wet, plastic condition (fig. 7, A) and by overgrazing. Heavy sod, obtained by controlled grazing the previous summer and fall, will stand trampling fairly well, but trampling is most injurious on thin, overgrazed sod, where every opportunity should be given for rapid spring growth. Trampling thin grass when the soil is wet and soft destroys the plants and puddles the soil so that its structure is such that the growth of



FIGURE 6.—Winter bluegrass pasture in Kentucky. Note the haystacks. The hay can be used for barn feeding when livestock should be kept out of pastures.

grasses and clovers is retarded for the remainder of the growing season. The economy of grazing pastures and meadows at such times is questionable. Soil erosion is almost an inevitable result. It is good management to cut more hay in order to keep cattle off pastures under certain conditions.

ROTATION OF PASTURES

Considerable planning should be done to divide pastures into units that may be rotated according to good pasture-management practices and utilization of the feed available (fig. 7, B). The availability of water in each pasture determines in part how the pasture may be divided. The expense of piping water to troughs, constructing stock ponds, or providing other watering places is usually a good investment when greater production of pasture through controlled grazing is considered. Electric fences may be used to divide pastures tem-

porarily and make meadows available for periodic grazing. Another consideration in pasture management is the fact that different kinds of livestock have different grazing habits and prefer different types of



FIGURE 7.—A, Cattle and sheep have been turned onto this pasture under all weather and soil conditions. The broken sod in the foreground cannot protect this steep slope from erosion. B, This pasture is divided into units to permit controlled grazing. Since the pasture on the left should not be grazed much more closely, the livestock will soon be turned onto the pasture on the right, which has recovered sufficiently from previous grazing. Such a practice keeps the sod thick, insures abundant forage at all times, keeps moisture on the land, and prevents soil erosion.

vegetation. It has been shown that total returns in livestock and livestock products may be increased when various kinds of livestock are grazed together. Pastures grazed by cattle and sheep at the same time or in succession are usually freer from weeds and more productive.

SUPPLEMENTAL PASTURE

In some areas pasture improvement may increase yields only in the spring or at times when the pasture is usually sufficient. In practically all areas of the Ohio Valley Region full economic use of improved pastures must depend on management plans that include supplemental pastures for the increase of production in months of normally low yield. In areas of low rainfall in July and August, such as are found in Michigan, there is difficulty in obtaining adequate yields from pastures of Kentucky bluegrass and white clover, and therefore more dependence will have to be put on supplemental pasture supplied by sweetclover, Sudan grass, and the grazing of alfalfa-bromegrass meadows after the first cutting. In the southern sections of the Ohio Valley Region wider use of Bermuda grass in pastures and the provision of supplemental grazing on lespedeza and redtop will help. During the winters in southern areas the provision of supplemental grazing from crimson clover, small grains, and a mixture of ryegrass and vetch will assist in solving the problem.

YIELDS ON IMPROVED PASTURE

In areas such as northeastern Ohio pasture improvement is evident over the entire year, with the exception of the months when the soil is frozen and during occasional droughty summers. In these areas it is usual for improved pastures to start growing from 1 to 3 weeks earlier in the spring than unimproved pastures and to yield better during the summer months. In tests on poor pastures of central Indiana, the farmers are reporting two to three times more pasture-days on the improved pastures than on the untreated check pastures in spite of dry conditions in the summer and fall.

CONTOUR FURROWS

On medium to poor pastures contour furrowing (fig. 8) may have some place in sod improvement, especially on sites where moisture is likely to be the limiting factor in the growing of grass.

As it is difficult to plow on the exact contour for any considerable distance, it is advisable to leave occasional small checks or dams in the furrows to prevent concentration of water at low points. The dams lessen the danger of overtopping. The furrows should be so spaced that they will hold the run-off of ordinary rainfall but should not be deep enough to expose raw subsoil. The closer together the furrows are placed, the greater will be the growth over the entire area during dry periods. Close spacing, however, increases the difficulty of mowing unless the furrow cross section is gradual enough to allow equipment to cross it.

Contour furrowing, in many respects, is still in the experimental stage. There is need for additional study and observation on rate, depth, and distribution of moisture penetration; width of spacing on various soil types, slopes, and degrees of erosion; maintenance requirements, and revegetation of ridges.

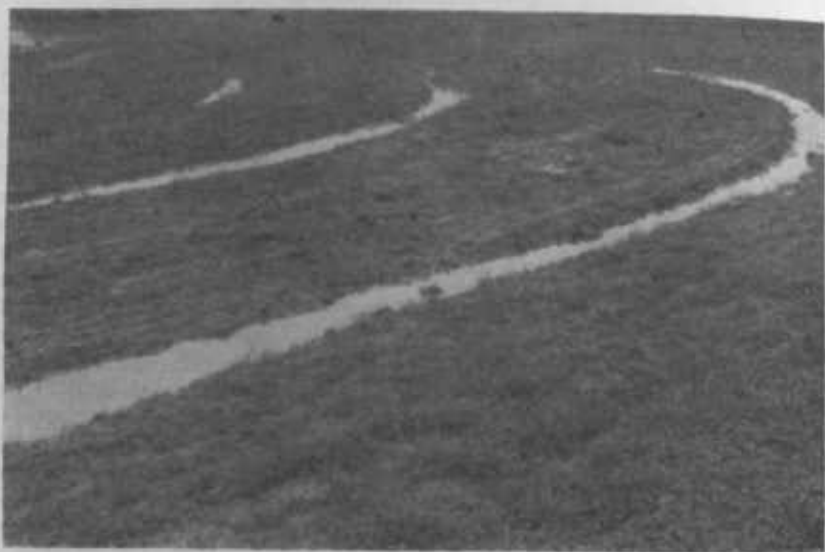


FIGURE 8.—Contour furrows prevent damage by run-off and hold water until the soil can absorb it.

PASTURES FOR HOGS AND POULTRY

Sod in pastures for hogs and poultry may not at first seem to contribute anything materially to erosion control. Nevertheless, in conserving our soil resources, we must search for practices or methods that cover the soil with a protective blanket and at the same time serve a useful economic purpose. The proper use of pasture for hogs and poultry constitutes good land use, contributes to erosion control, and increases the farm income.

We need only see the soil damage caused by pigs, particularly in corn-hog sections, where comparatively large numbers are turned out onto relatively poor pastures, to realize that hog farming may lead to serious erosion (fig. 9).

If the trampling, puddling, rooting, and overgrazing of pastures by pigs destroy the vegetation and expose the soil to erosion, it might safely be argued that the pasture be improved and the acreage increased, even if for no other purpose than to minimize the destruction of the sod in order to maintain a soil cover that resists erosion. That the provision of good pig pasture is remunerative, apart from the benefit of conserving soil and maintaining soil productivity, is shown by experiments at the Ohio Agricultural Experiment Station. The results of these experiments, published in 1935, indicate that the pigs on good pasture not only consumed large amounts of forage but

utilized their grain concentrates more effectively than pigs fed in dry lot. The pigs on pasture were ready for market 1 month earlier than pigs not pastured, and hence were able to bring the higher prices early marketed hogs usually bring. On the basis of the saving of feed, the pastures showed a value of \$16.27 per acre; when the price differential for earlier marketed hogs was also included, the value of each acre of forage was increased to \$16.53.

The best forage crop for growing and fattening pigs is one relatively high in protein and minerals, and it should be palatable and succulent. It should withstand trampling and grazing and produce new growth during the summer. Alfalfa has no superior as a forage crop for pigs, although studies at the Ohio station indicate that red clover and Dwarf Essex rape are also satisfactory.



FIGURE 9.—Without proper management, hogs cause extensive injury to pastures.

Considerable experimental work with poultry of all kinds indicates that proper range (pasture) provides an economical supply of succulent green feed, including the vitamins and minerals contained in the pasture plants, and a soil free from disease and parasites. These benefits have been shown to be effective in increasing the hatchability of eggs and reducing the cost of rearing layers and the mortality of pullet layers, all of which have a definite monetary value. The provision of adequate poultry range is a land use not to be neglected.

A variety of crops may be used for poultry range, but rotation of range on permanent bluegrass pasture has been shown to offer a number of advantages over specially planted ranges of such crops as alfalfa, clover, and rape. Frequently small areas on the farm may be protected from erosion and still be made to yield considerable income through use as range land or pasture for poultry. Since poultry damage the sod adjacent to shelters where they concentrate, shelters should be moved before the sod is too badly worn to permit rapid recovery.

SOD IN CULTIVATED FIELDS

Sod may be put to one of its most remunerative uses in the maintenance of soil productivity on cropland. Virgin soils, developed under woodland and grass in the Ohio Valley Region, were comparatively high in organic matter. They contained masses of decaying roots and humus built up by the humidified root remains. When it was first plowed, the soil was springy, spongy, and porous. It retained its granular, porous structure and resisted compaction for many years. But under cultivation the more raw and coarse organic fragments decayed, and finally even the humus residue was oxidized (destroyed by the chemical action of the oxygen in the air). Fre-



FIGURE 10.—Under sod most soils assume a granular, porous structure.

quent cultivation and the loss of these organic residues destroyed the natural open structure and gradually compacted the soil. In many instances this compacting process has pressed into the space of a cubic foot 25 to 30 percent more of the solid material than was found in porous virgin soil occupying the same amount of space. As a result of these changes in soil structure, root development is hampered, the water-storage capacity of the soil is reduced, and crop production decreased.

MEADOW STRIPS IN ROTATIONS

One of the best ways to improve the structure of the soil and restore its productivity is using meadow strips in rotations. Practically all soils are found to be in better physical condition after they have grown a heavy crop of grass, or preferably a grass-legume mixture, for a few years. Under grass, most soils assume a granular or crumblike structure (fig. 10). They become more like the open and porous virgin

soil. Legume-grass meadow strips in rotations add nitrogen to the soil, increase the amount of organic matter, and improve the soil structure. Grasses and legumes are effective in strip cropping only if they put forth a vigorous, dense growth. On many fields, rotations should be lengthened to include 2 or more years in sod to get the full soil-improving effect of a more mature and effective sod crop for the benefit of the crop that follows.

In order to get a dense sod in the meadow strip the farmer is justified in going to more than the normal expense in establishing meadow strips. The use of fertilizers, including top dressings of manure on grain crops in which the meadow mixtures are included, will produce a greater yield of grain and at the same time will be most useful in establishing the following meadow crops.

These meadow strips play an important part in farming in the Ohio Valley. On some farms there is not enough level or nearly level land to produce the needed cultivated crops. The gently sloping lands may be used for crops under a strip-cropping system in



FIGURE 11.—Strip cropping in Pennsylvania. The rotation is corn, small grain, and legume-grass sod.

which meadow strips in the rotations are used more prominently as the degree of slope increases. The meadow strip planted on the contour slows and absorbs the run-off from the cultivated strip above (fig. 11). It acts as a buffer against heavy wash of water into the cultivated field below and filters out much of the soil that may be carried by the run-off.

Returns from crops are increased on fields where grass is used to improve the soil.

GREEN MANURE

Under proper management clovers and grasses are unexcelled as soil-building crops. Even a meadow with a crop valuable for feeding or marketing, such as alfalfa, should sometimes be plowed

under as green manure. A ton of air-dry alfalfa contains approximately 50 pounds of nitrogen, 10 pounds of phosphoric acid, 40 pounds of potassium, and calcium and magnesium equivalent to 100 pounds of limestone. At prevailing prices of fertilizer it would cost about \$8 to replace these elements in the form of commercial fertilizer. When meadow fields are to be plowed under for other crops it is not always economical to harvest the last cutting, unless for feeding or unless the market price for hay is sufficient to pay a cash return greater than the cost of harvesting and marketing and the value of the nutrients as fertilizer.

WINTER COVER

Small grains, grasses, and clovers, and mixtures of these make ideal winter cover crops and should be used whenever practicable on all row-crop areas to shorten the season during which these areas are



FIGURE 12.—Cotton land protected by rye and vetch. Several other winter covers may also be used.

subjected to erosion. Small grains alone or mixtures of vetch and ryegrass and sweetclover and crimson clover seeded with grasses are used to good advantage as winter cover crops (fig. 12). They may be planted to provide early spring grazing, and this helps to keep livestock off the permanent pasture at a season when it may be injured. These cover crops take up nitrogen and other plant-food elements from the soil and prevent their loss by leaching and erosion. When plowed under, they return these fertilizing elements to the soil along with a supply of manufactured organic matter. Thus the area is protected during the winter from losses of soil, moisture, and plant nutrients, and the row crop that follows benefits from improved soil structure, a greater supply of organic matter, more moisture, and increased soil fertility. The numerous benefits more than repay the extra cost of the cover or green-manure crop.

GRASSED DRAINAGEWAYS

Terrace systems accumulate large quantities of water that must be discharged safely. Frequently new gullies are started and considerable damage done if outlets and outlet channels are not well planned and constructed. Expensive structures in outlets and drainageways should not be used where sod outlets and drainageways can be constructed at much less expense. Broad-bottom sod drainageways are recommended to reduce the velocity of discharge water. These vegetated outlet channels are easily maintained and require no technique, labor, or material beyond that available to the farmer.

Usually drainageways should be constructed and put into sod before the water from the terrace system is diverted into them. Often



FIGURE 13.—This natural depression seeded to grass makes a drainageway in which there is little danger of gullying.

there is at most not more than one growing season for establishing this protective covering before the water is drained into the outlet. Under such conditions seeding at pasture or meadow rates will not produce a turf thick enough to prevent cutting in the outlet. Seeding at rates approaching those recommended in establishing lawns more nearly meets the demands in drainageways. Frequently in building outlet channels the farmer is faced with the problem of establishing or improving turf on subsoils lacking in organic matter, acid in reaction, or deficient in fertilizing elements such as phosphorus, nitrogen, and potassium. Under such conditions normal, or meadow, treatments probably will prove inadequate, and the usual rates of application may be doubled or even trebled, depending on the extremity of the soil condition. Any additional expense for seed, fertilizer, lime, a mulch of manure, or sodding may amount to a small fraction of the cost of constructing the terraces and grading the outlet channel. It is therefore unwise to carry economy too far.

On unterraced and strip-cropped fields there are almost always irregularities such as natural swales or draws where run-off from the field concentrates. These should be maintained in sod (fig. 13). They become gullied if they are not protected.

These broad drainageways in natural depressions, whether they serve terraced or unterraced fields, may be used for hay or pasture.

Detailed information on the construction of grassed drainageways is given in Farmers' Bulletin 1814, Terrace Outlets and Farm Drainageways.

DIVERSION DITCHES

It is sometimes necessary to protect fields against run-off from adjacent areas. This can be done by an intercepting ditch, or diversion ditch. Such ditches on erodible soils should be left in sod. When the land above a diversion ditch is cultivated, a sod buffer strip above the ditch will filter out sediment and prevent the channel from filling.

SOD IN ORCHARDS

Hillsides that can be protected from erosion are desirable locations for orchards. In hillside orchards the trees should be planted on the



FIGURE 14.—A peach orchard planted on the contour. A cover crop of rye and vetch has been disked down as a mulch.

contour. Sod strips in the tree rows will add to the beneficial effects of contour cultivation (fig. 14). The objection has been made in connection with some orchard crops that the sod uses sufficient moisture and fertilizing elements to reduce fruit yields. Orchard economy, however, cannot be based on maximum annual yield alone. A slight reduction in annual yield, or even a considerable reduction, can be justified if valuable land can be protected from loss of topsoil and eventual gullyng and the life of the orchard thereby prolonged. Where protection from erosion is necessary, the annual decrease in yield will be negligible in comparison with the greater total yield obtained over the longer period of years during which the orchard will be productive.

SOD ON OTHER ERODED AREAS

IN GULLIES

Usually gullies expose unproductive soil, and special treatment, such as careful seedbed preparation with extra seed, lime, and fertilizer, is required to get an adequate catch of grass and legumes. Where practicable, water should be diverted from gullies. Gully banks that are too steep for grass to grow on (fig. 15) should be graded to a more gentle slope before they are seeded. Any available



FIGURE 15.—Gully banks, sloped and treated, can be stabilized by vegetation.

topsoil may be scattered well over the area. Mulching with straw or branches protects the seeding and conserves moisture. Cattle should be kept out of gullies until the sod is established. This may be done by laying thorny brush on the gully banks or by temporary fencing. Vigorous local grasses may frequently be used to advantage. Grasses that farmers sometimes treat as weeds may survive on poor, gullied areas where other grasses fail. Excellent stands have been obtained with Bermuda grass in the South and quackgrass in the North on areas sodded with these grasses or planted with rootstocks and surface creepers.

Soil-saving dams should be used only to supplement and assist vegetative control in gullies. If, after the banks are graded, the drop into the gully is too steep to be controlled with vegetation, temporary structures may be used to keep gullies from cutting back until sod is established. In gullies so large as to be worthless for pasture, mulching and seeding to grass and legumes, in addition to the use of trees and shrubs, may be advisable. Such areas are of considerable value for wildlife.

A bulletin on the control of gullies on farm land that will be useful to farmers in the Ohio Valley Region is Farmers' Bulletin 1813, Prevention and Control of Gullies.

ALONG STREAM BANKS

Cultivating too close to stream banks increases bank slips and cave-ins and may cause streams to meander and destroy valuable bottom land. Banks stabilized with sod and trees and shrubs close to the water's edge hold the stream to its channel and provide valuable food and cover for farm wildlife.

ALONG HIGHWAYS

Eroding highway banks and ditches are dangerous and costly. They can be stabilized with sod. Great strides are being made in the use of sod on highway rights-of-way. Even the most extreme erosion is being corrected by vegetation, which can be successfully established if attention is given to fertilizing, timely planting, selecting vegetation in relation to progression of plant species, grading, seedbed preparation, and mulching (fig. 16).



FIGURE 16.—A roadside ditch and bank slope protected by mulching and grass seeding. Prevention of highway erosion protects adjacent farm land.

ON BLOW-OUTS AND DUNES

On the borders of the Great Lakes, particularly in Michigan, and to a lesser degree in Indiana and Ohio, wind erosion is becoming a serious menace to farm and resort lands and to highways. After the natural protective growth of trees was removed and the covering of leafmold was plowed into the naturally thin sandy topsoil, the soil soon started to blow; and, once the wind had removed all protection, the fine sandy subsoil was exposed. These bare subsoil areas, or blow-outs, quickly enlarge unless treated, and the sand blown from them collects in ridges and dunes. The dunes move gradually, sometimes shifting their courses, and cover good farm land and other valuable property, sometimes to great depths. Consequently wind

erosion is causing damage in two ways, by causing blow-outs devoid of topsoil and by covering good land with poor, fine sand.

Agencies and individuals are trying to bring this type of wind erosion under control; in this fight against another form of man-made erosion, sod is a valuable aid. Many plantings of European beach grass have been successfully established on both blow-out and dune areas and are holding the soil against movement. Other grasses such as long-leaved reedgrass and switchgrass are growing naturally in these areas. They show possibilities of being adapted to the control of erosion. It is felt that, once these areas are stabilized, a succession of plants may be encouraged that may finally terminate in trees.

SOD FOR USE BY WILDLIFE

Many of the most desirable forms of farm wildlife, such as the bobwhite quail and field-nesting song birds, depend to a considerable extent on the food and cover provided by legumes and grasses.

The destruction of the soil cover over large areas formerly occupied by native grass and forest has resulted not only in serious erosion but in a substantial reduction in the numbers of many valuable kinds of wildlife. Without cover, the birds and mammals that feed on and help to control injurious insects cannot remain to play their part in the farm economy. Like farm livestock, farm wildlife is given a better chance for success with the wider use of good legume and grass sods.

FERTILIZERS AND SOIL AMENDMENTS

Growth of grass cannot exceed its limiting factors. Moisture is probably the most critical factor, since sod plants are made up largely of water and can absorb nutrients from the soil only when such nutrients are in solution. The farmer cannot control the rain, although by cultural practices he can influence the storage of moisture in the soil. And he can control the four important nutrients needed in pasture growth, namely, nitrogen, lime, phosphate, and potash, which are most important in balancing the fertility and productivity needs.

In the form of proteins and other organic compounds, clovers and grasses at certain stages of development contain comparatively high amounts of nitrogen. There is an inexhaustible source of this element since nearly four-fifths of the air is nitrogen. No agricultural plants are able to take nitrogen from the air above ground, but in the presence of the right kind of bacteria, legumes are able to obtain nitrogen from the free air in the soil. This accounts for the necessity for proper inoculation, and for the fact that legumes can increase the soil-nitrogen content. Except the legumes, all agricultural plants (including grasses) are dependent largely on the nitrogen in the organic compounds in the soil and to a lesser extent on inorganic soil compounds containing nitrogen. The soil-nitrogen supply may therefore be built up in sod lands by the fixation of atmospheric nitrogen through the action of micro-organisms and by the nitrogen content of the soil organic matter, increased through the decay of grass and clover roots.

The immediate effect of nitrogen on grasses and clovers is to promote abundant green growth as well as increased root growth. When grasses are growing with legumes, the nitrogen supply is usually adequately cared for, but nitrogenous fertilizers are sometimes required for grasses before legumes are established or for further increase in growth at particular seasons. When grasses are planted on unproductive, eroded soils, which are particularly deficient in organic content, the growth of a legume immediately preceding planting or the direct application of nitrogen is almost always necessary in order to produce a good catch or adequate growth.

Phosphate, potash, and lime are contained in various amounts in clovers and grasses and are closely associated in their effects on plant growth. Grasses and clovers require various amounts of all three, and no adequate growth of either grass or clover can be obtained without them. Lime, apart from its effect on the plant, also neutralizes the organic acids and other acids in the soil. Lime has an important effect on soil organisms, and the fixation of atmospheric nitrogen cannot go on properly in the absence of lime. Most clay and silt soils contain sufficient potash for grasses, but clovers often respond to potash applications even on these soils. Coarse or sandy soils and muck soils usually are deficient in potash and cannot meet this need for either grasses or clovers. There are other elements needed for growth of grass and clover, but it is only rarely that soils are so deficient in these that any appreciable response is obtained through their application.

LIST OF COMMON AND SCIENTIFIC NAMES OF PLANTS REFERRED TO

- Alfalfa (*Medicago sativa*).
- Bermuda grass (*Cynodon dactylon*).
- Bromegrasses (*Bromus* spp.).
- Criason clover (*Trifolium incarnatum*).
- European beach grass (*Ammophila arenaria*).
- Hairy vetch (*Vicia villosa*).
- Hop clover (*Trifolium agrarium*).
- Kentucky bluegrass (*Poa pratensis*).
- Korean lespedeza (*Lespedeza stipulacea*).
- Lespedeza sericea*.
- Long-leaved reedgrass (*Calamovilfa longifolia*).
- Orchard grass (*Dactylis glomerata*).
- Poverty grass (*Danthonia spicata*).
- Prairie Three-awn (*Aristida oligantha*).
- Quackgrass (*Agropyron repens*).
- Rape (*Brassica napus*).
- Red clover (*Trifolium pratense*).
- Redtop (*Agrostis alba*).
- Reed canary grass (*Phalaris arundinacea*).
- Ryegrasses (*Lolium* spp.).
- Smooth bromegrass (*Bromus inermis*).
- Sudan grass (*Sorghum vulgare* var. *sudanense*).
- Sweetclover (*Mellilotus alba*).
- Switchgrass (*Panicum virgatum*).
- Three-awn grass (*Aristida dichotoma*).
- Timothy (*Phleum pratense*).
- White clover (*Trifolium repens*).

OHIO VALLEY REGION OF THE SOIL CONSERVATION SERVICE

(July 1939)

DEMONSTRATION PROJECTS

Bedford, Ind.
 Fowler, Ind.
 New Castle, Ind.
 Falmouth, Ky.
 Madisonville, Ky.
 Paducah, Ky.

Benton Harbor, Mich.
 Howell, Mich.
 Traverse City, Mich.
 Cambridge, Ohio
 Hamilton, Ohio
 Mount Vernon, Ohio

Wooster, Ohio
 Zanesville, Ohio
 Humboldt, Tenn.
 Springfield, Tenn.

LAND PURCHASE PROJECTS

Burns City, Ind.
 Nashville, Ind.
 Eddyville, Ky.
 Hopkinsville, Ky.
 Pineville, Ky.

Allegan, Mich.
 Ashland, Ohio
 Chillicothe, Ohio
 Duncan Falls, Ohio
 McArthur, Ohio

Henderson, Tenn.
 Lebanon, Tenn.
 Lexington, Tenn.
 Livingston, Tenn.

S. C. S. NURSERIES

Washington, Ind.

Paducah, Ky.

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S. C. S.-C. C. C. EROSION CAMPS

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 Dresden, Tenn.
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S. C. S.-C. C. C. DRAINAGE CAMPS

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 Frankton, Ind.
 Lebanon, Ind.
 Monon, Ind.
 Portland, Ind.

Valparaiso, Ind.
 Owensboro, Ky.
 Sebree, Ky.
 Attica, Ohio
 Bowling Green, Ohio

Dellance, Ohio
 Middlepoint, Ohio
 Elyria, Ohio
 Findlay, Ohio
 London, Ohio

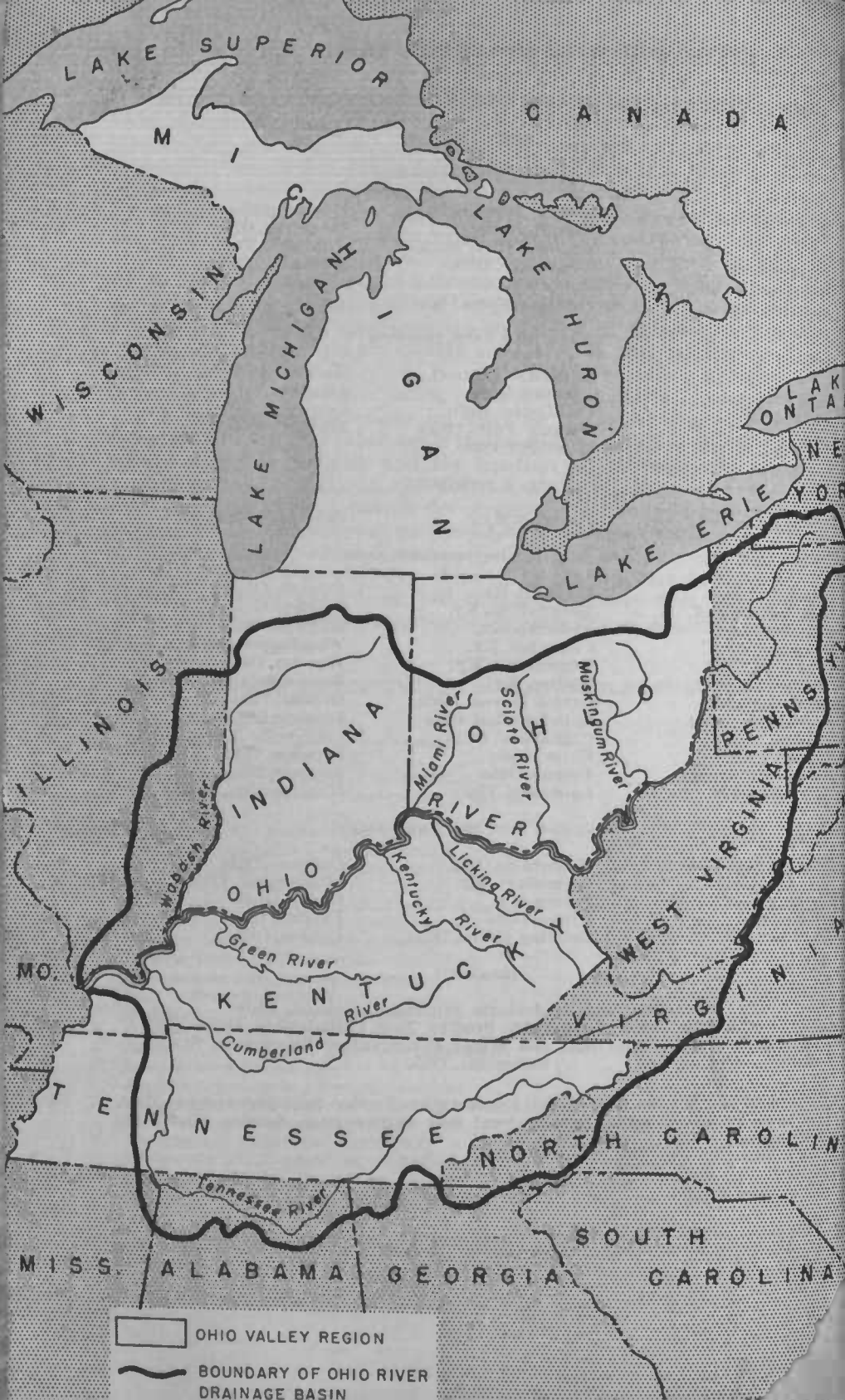
RESEARCH



Watershed and Hydrologic Studies, Coshocton, Ohio
 Climatic and Physiographic Studies, New Philadelphia, Ohio
 Northwest Appalachian Soil and Water Conservation Experiment Station,
 Zanesville, Ohio

The public is invited to visit Soil Conservation Service work areas at any time.
 See your county agent or any local Soil Conservation Service official for
 information.

U. S. GOVERNMENT PRINTING OFFICE: 1939

For sale by the Superintendent of Documents, Washington, D. C. - - - Price, 5 cents



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